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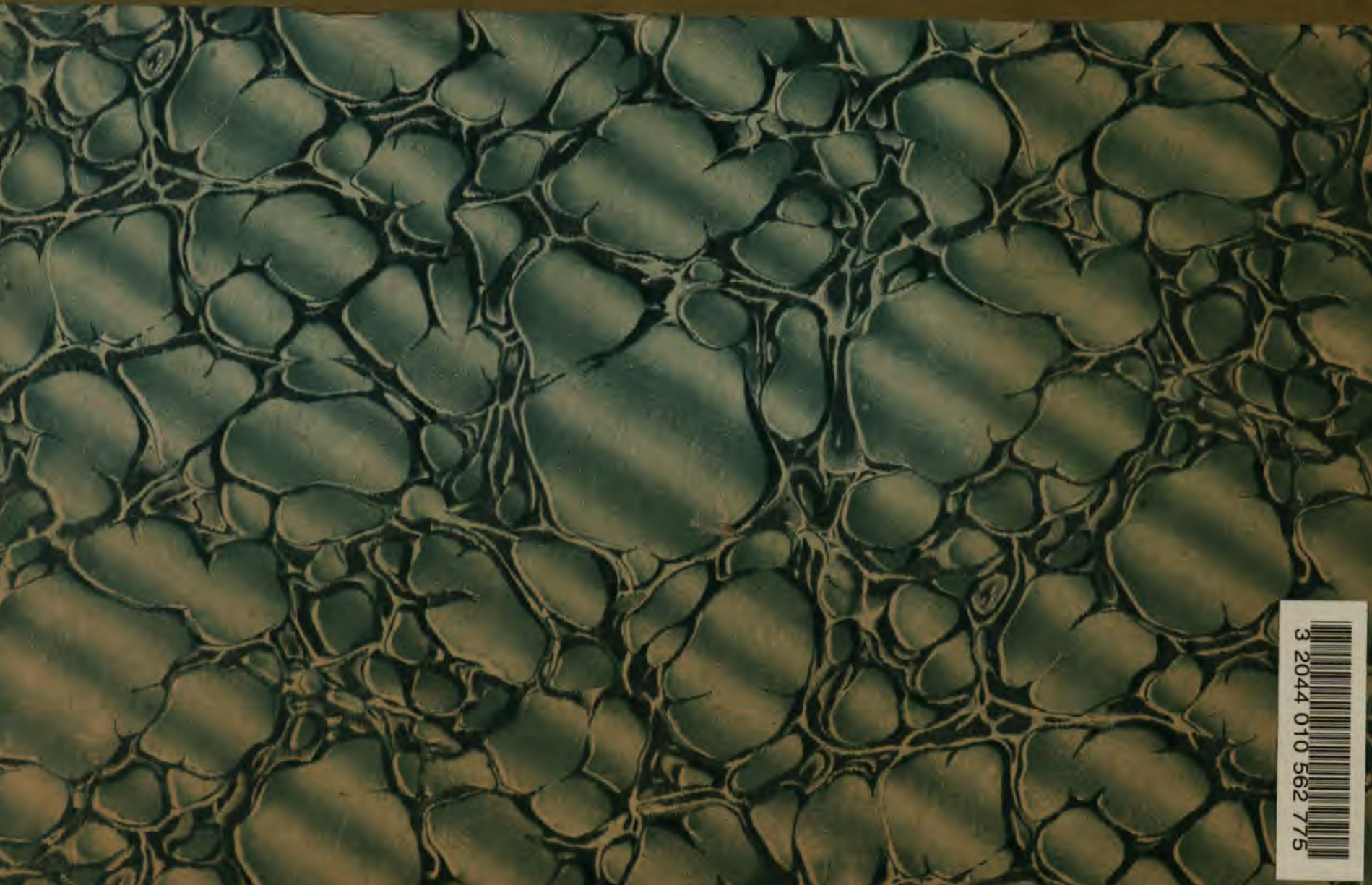

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THE SANITATION OF BATH HOUSES

BY

WM. PAUL GERHARD, C.E.
Dr. Eng. Hon. C.

I. Types of Public Baths

II. Sanitary Features of Swimming Pools

III. The Water Supply and the Purification of Swimming Pool Water

IV. Some Engineering Details of Bath House Installations

Twenty-Eight Illustrations

Reprinted from "Architecture and Building"

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The Sanitation of Bath Houses

By Wm. Paul Gerhard, C. E., Dr. Eng. Hon. C.

I. Types of Public Baths

In American cities, as well as in those abroad, we observe certain well-defined groups or types of public bathhouses, viz.:—

(1)—People's bathhouses, which are in most cases free to the public;

(2)—Public bathhouses with swimming pools;

(3)—Open-air public baths, comprising

- (a) seaside or surf baths;
- (b) river baths;
- (c) wading and bathing pools in public parks or in private estates.

(4)—Commercially operated bathhouses;

(5)—Medical baths, usually attached to private sanatoria.

The types named differ from one another, not only in their aim and location, but chiefly in their planning and in their more or less elaborate bathing equipment.

Classifying them according to the results desired, we can distinguish four types of baths, viz.:—

(1)—Hygienic or cleansing baths—those taken to keep the skin clean, and to promote or maintain health by cleanliness of the body and by the proper functions of the skin.

(2)—Baths for recreation and physical exercise—those which promote bodily health only indirectly.

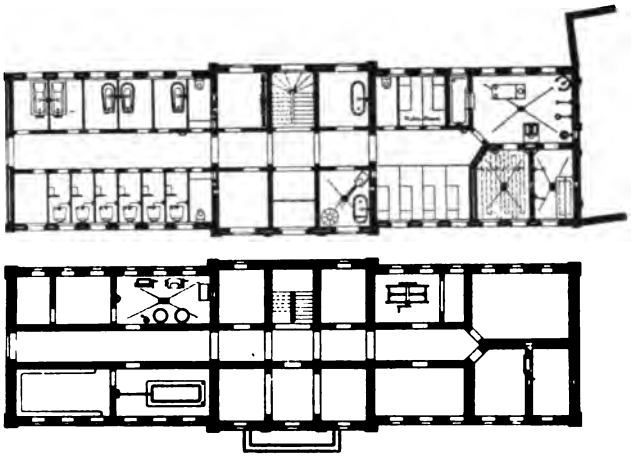
(3)—Baths for refreshment and for the hardening of the body.

(4)—Baths for healing—for the cure of disease by the application of so-called medical or curative baths.

Of all types of baths, the *cleansing* baths are those of the foremost importance, not only for the health of the individual, but also for the attainment of a higher degree of sanitation in a community. It is generally conceded that the tepid douche or shower is the most sanitary type of cleansing bath.

View of People's Bathhouse, Type I.

Second in importance are the baths taken in natural or in artificial pools for physical exercise, for the sake of recreation, for the love of the healthful sport of swimming. Such baths are in no sense intended as cleansing baths. Swimming is, without doubt, one of the best forms of bodily exercise, yet it should be borne in mind that it cannot be conducive to health, if the water is badly polluted, or if the swimming hall is overcrowded and badly ventilated.



Type I. Plan of Basement and First Floor of People's Bathhouse, with Rain Baths and a Few Tub Baths. Pupils' Rain Bath in Basement.

The refreshing or cooling-off of the body during the warm season of the year, or at all seasons after the taking of violent athletic exercise, can be attained alike in the shower or in the pool. The hardening of the body can be accomplished, after a warm tub bath, by the taking of a tepid or cold douche, administered from either a hand spray or an overhead douche.

The treatment of bodily ailments by the use of the many forms

Interior View of Rain Bath and Dressing Compartment in Type I Bathhouse.

of curative baths is more in the nature of a medical subject, hence foreign to this discussion.

So far as the health of a city or a community is concerned, by far the most important are the people's cheap or free bathhouses. These should be located in the center of populous districts, occupied by the working classes and by the poorer people in general. In large cities, obviously, more than one such bathhouse will be required. The ruling principle should be to decentralize the baths; in other words, rather than have one large bathhouse, with hundreds of bath units, the large city should establish a number of smaller bathhouses, each accommodating a limited number of bathers.

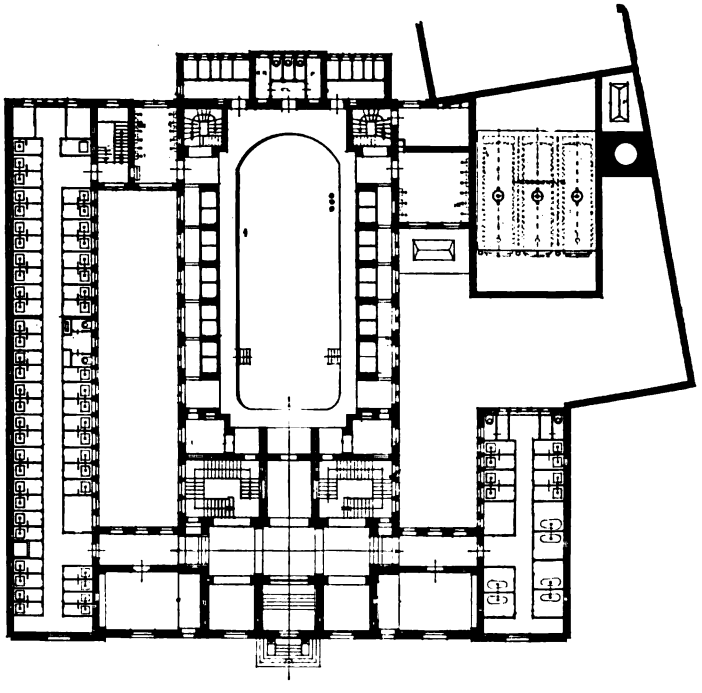
The buildings should have unpretentious exteriors, and the interiors should be simple yet sanitary. Monumental buildings, from an architectural standpoint, are decidedly out of place. This criticism may, with some justification, be applied to some of the city bathhouses erected in the past years.

It is customary to provide in people's bathhouses a few tub baths for women and for the smaller children, but the main equipment should consist of shower baths. This type of bath, the "rain bath," as it is sometimes called, is without the shadow of a doubt the cleanest and most sanitary, because the water used in the ablution of the body flows at once away, without the body of the bather staying, as it necessarily does in the tub bath, in contact with the dirty, and sometimes contaminated water.

People's bathhouses should be municipal institutions and they should be kept open during all seasons of the year. It is at least debatable, in my judgment, whether or not to provide this type of bathhouse with a swimming pool in addition to the showers, because of the additional cost involved in the construction of a watertight and sanitary pool, and further because of the formidable difficulty of keeping the pool water at all times pure and unobjectionable.

In the interest of municipal economy I have time and again made the feasible suggestion to utilize such rainbaths as are already provided in public schools during the evening hours for the public at large. This has successfully been done in some of the school-houses of European countries. In smaller communities, such rainbaths may be located in already existing buildings, for instance in the unused parts of the basement of a town hall, or in connection with a fire engine station, or even in connection with a village library building. The provision of cleansing baths in prosperous villages is a subject worthy of the special and closest attention of village trustees, of civic and health organizations and of womens' clubs.

The bathhouses of the second type have the much-coveted additional provision for swimming in the pool. They are either open-air baths, available only during the summer, as for example the river baths, the seaside baths, and the so-called wading and bathing pools provided in many city parks, or else they are enclosed bathhouses, heated during the winter season and thus made service-



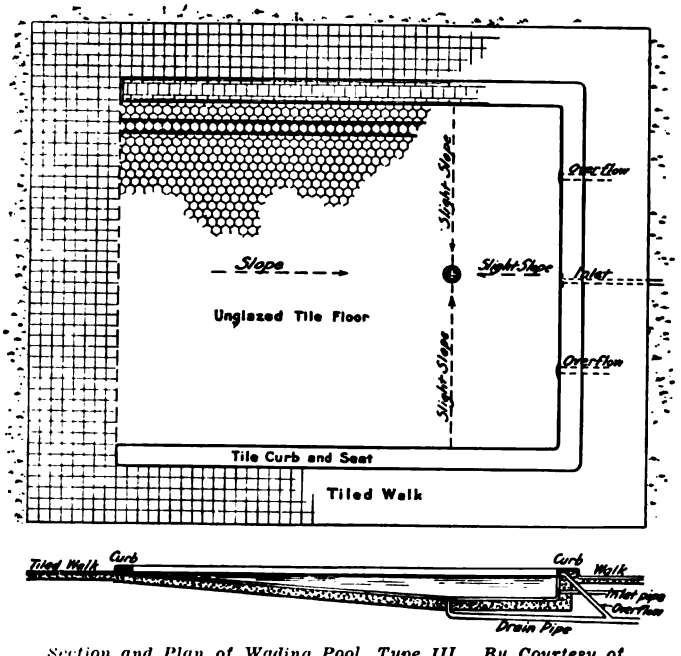
Type II of Public Bathhouse with Rain Baths, Tub Baths and One Swimming Pool. Men's Side on the Left, Women's on the Right. Pool Used by Women on Alternate Days.

able during the entire year. Their equipment consists of (1) baths for cleansing, showers and perhaps a few tub baths, and (2) the swimming pool.

Where natural watercourses are available, which have a *pure* flowing water supply, river baths are, in some sense, better than artificial indoor pools. But where the river water is impure or sometimes sewage-polluted the floating river baths should be abolished, as they may become the source of serious infection. In such cases the public authorities should provide efficient and economical substitutes, such as open-air summer pools, enclosed on the sides only and open to the sky at the top, which have proved successful in some inland cities. (Type III.)

Municipal cleansing and pool baths should, if possible, be free to the public. Where the cost of maintenance is high a small fee might be charged for the use of the pool only, leaving the use of the shower baths free.

View of Outdoor Private Pool, Type III. By Courtesy of Associated Tile Manufacturers.



Section and Plan of Wading Pool, Type III. By Courtesy of Associated Tile Manufacturers.

To the fourth type belong all those bathhouses which are built by private enterprise and operated on a commercial basis. Their equipment can be made more elaborate and hence usually comprises all kinds of baths, including Turkish and electric baths and massage rooms. Such private bath establishments always charge a fee for admission, and additional prices for the several kinds of treatments. They are more common in the cities of Continental Europe because of the lack of bathing conveniences in many of the homes abroad. It is necessary that they should be at all times under the direct sanitary control of the board of health.

As already mentioned, the fifth type of baths, namely, medical baths, are beyond the scope of this essay. I wish to point out that common to all the types of bathhouses is the chief and, to my mind, uppermost requirement of *cleanliness*. This can be secured and maintained by the use of appropriate materials of construction, by suitable planning, arrangement and equipment, by ample lighting and ventilation, and by the enforcement of certain general rules of conduct applicable to all bathers, of which more will be said further on.

II. Sanitary Features of Swimming Pools

The swimming pool is, undoubtedly, considered by young and old alike, the most popular feature of a public bathhouse. It deserves popularity only if its sanitation is properly maintained. We will, therefore, discuss more in detail the main points involved in the design, construction and equipment of sanitary pools. Briefly stated, these points embrace—

1—The location, construction, equipment and devices to insure safety to the bathers;

2—The supervision and cleanly maintenance of the pool, of the various parts of the building immediately adjoining the pool, and the control of the bathing patrons;

3—The management of the water supply, its heating, filtration, sterilization, and re-circulation.

The hall, in which a swimming pool is located, should be lofty, well-lighted and adequately ventilated. A pool loses a great deal of its attraction if it is placed in a dark room, with a low ceiling, where sunlight and outside fresh air cannot readily be admitted.

Some sanitary experts advocate placing the pool in a one-story structure covered with a roof, arranged with proper mechanism so that it may be partly opened up in summer time to admit the sunlight and to assist in the ventilation of the place. A swimming pool so arranged would practically afford an opportunity to bathe in the open air during the warm season.

It is desirable to limit the dimensions of a swimming pool, for it is obvious that the larger a pool is made the more costly become the filling with fresh water and the warming of the water to a proper temperature.

The usual standard dimensions of a pool are 25 feet in width and 60 feet in length. A pool of this size has a water capacity of approximately from 78,200 to 106,400 U. S. gallons and is wide enough for five swimming lanes. The contents of a pool in gallons or in cubic feet depend, of course, upon the depth of water. It is usual to make this 3½ feet at the shallow end (the part used by non-swimmers), and 6 feet or more at the deep end, where the jumping and diving-board is located. For diving a depth of not less than 12 feet, or better 15 feet, is advised, and this depth should be located at a distance of about 10 feet from the deep end. This gives a sufficient depth to allow persons, who are experienced, to dive with safety.

Some pools, as, for instance, the large pool in the Madison Square Garden, New York City, have the deepest part of the pool in the middle, this part being recognizable by the darker color of the water, and by the location of diving towers.

Many indoor pools have been built in recent years, the dimensions of which exceed the above standards, as, for instance, the many swimming pools of California cities.

View of Larger Public Bathhouse, Type IV.

NOTE:—Special Works, treating in detail of Bath Houses, Swimming Pools, Medical, Sun and Air Baths, are the following:

John K. Allen, Swimming Pools, their Construction, Mechanical Installation and Water Supply (an American publication).

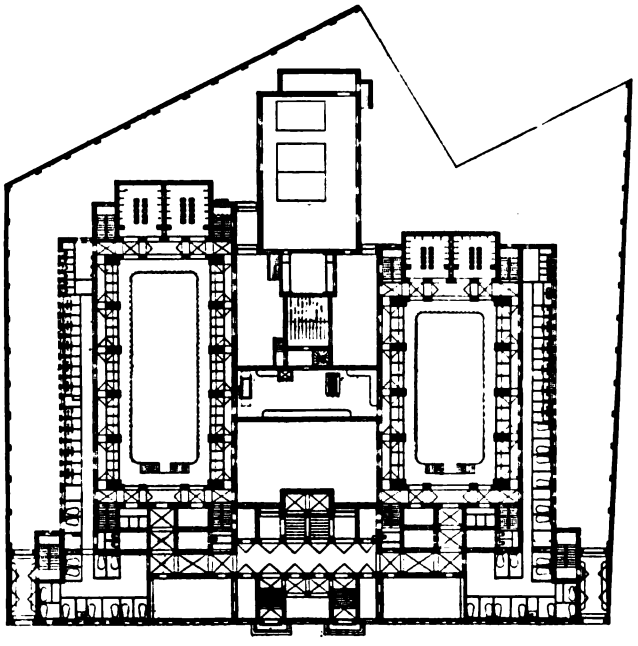
Dr. Wm. P. Gerhard, Modern Baths and Bath Houses (an American publication). For contents see third page of cover.

Alfred W. S. Cross, Public Bath and Wash Houses (a British publication).

W. Schleyer, Bäder und Badeanstalten (a German publication).

Leo Vetter, Moderne Bäder (a German publication).

the pool at the West Point Military Academy, and others, but the majority of pools in clubhouses and in Y. M. C. A. buildings, follow the standards given above. Open-air wading pools do not, as a rule, follow any particular standard of dimensions; their outlines are often irregular.



Plan of First Floor of Bathhouse on Page 4

The pool should form a perfectly watertight basin. It may be built as a shell of steel, lined with concrete and with waterproofing, or else it may be constructed of stone work, brick work, or reinforced concrete masonry. Proper waterproofing of the bottom and sides is essential. The floor and the side walls of the pool should be finished with non-absorbent, impervious, durable and easily washable materials, preferably of a light color, and usually white. The choice of material lies between marble slabs, glazed or enameled brick, or ceramic glazed tiling (see the illustrations). All corners must be well rounded to facilitate cleaning operations.

After a visit of inspection to many European swimming pools the writer suggested lining the sides of pools up to the water line, with light blue glazed tiles, with a darker horizontal border at the water level, and with white tiling above it. Many of the public pools abroad unquestionably owe their attractive appearance to this constructive and decorative feature, not less than to their usually crystal-clear water.

By way of contrast, the cheaper-built pools, having a cemented bottom, or cement-lined brick walls, always convey the suggestion that they are far from clean or actually insanitary.

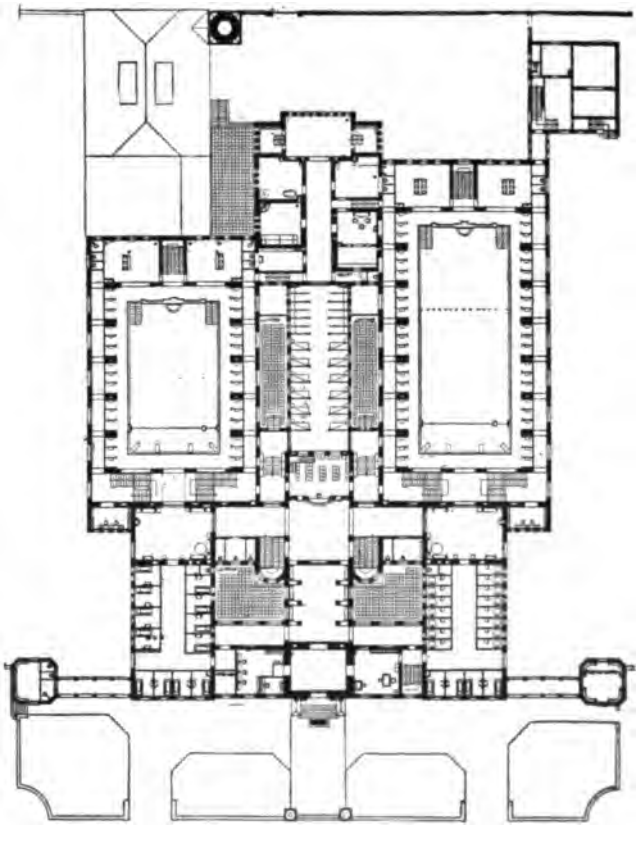
A pool should have a scum gutter at the normal water level, which should be carried all around the pool, or at least on three sides. This gutter serves for the removal of the lighter floating impurities, due to perspiration and exudation of the sweat glands of the surface skin, and of other debris, such as hair, dirt and dust, lint from bathing suits, and expectorations of swimmers. Sometimes such a gutter is constructed in ceramic tiling and forms not only an overflow drain, but also a life rail. It is provided with numerous oblong bronze gratings, which cover trapped waste pipes, which are sewer-connected.

It is quite obvious that the water in the pool should be kept constantly up to the level of the scum gutter, if it is to render efficient service, and this is best accomplished by providing a continuous inflow of pure and tempered water.

The walls of the main hall, where the pool is located, should be finished either with enameled brick, or with glazed tiling. Where economy does not preclude it, the ceiling should also be tiled, for plastered ceilings, as well as painted brick walls prove in the long run very unsatisfactory, because such surfaces are quickly attacked by the ever-present moist vapors.

The gangway surrounding the pool is sometimes covered with inlaid linoleum, but a material impervious to water is preferable, hence non-slip ceramic tiles are recommended. The floor should never slope or drain towards the pool, but it should have some floor outlets, connected directly with the bathhouse sewer. In some bathhouses a raised ledge is provided at the edge of the floor nearest to the pool, to keep dirty water from running into it.

The dressing rooms are usually located along the long sides of the pool. If so placed, it is a good plan to provide two gangways, an outer one giving the patrons access to

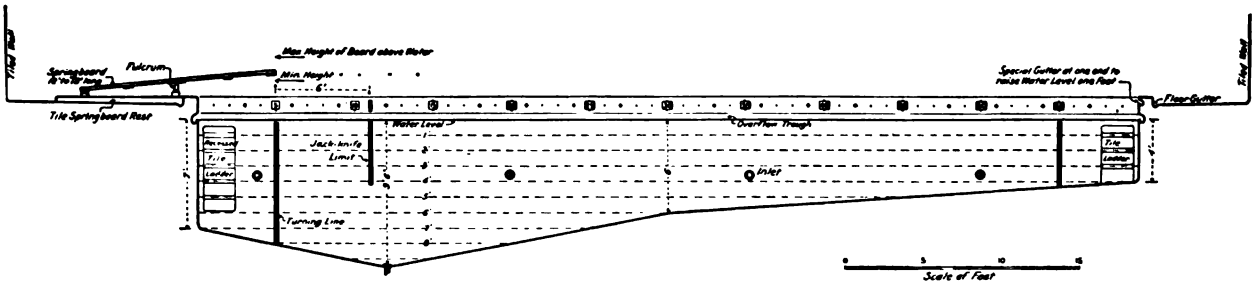


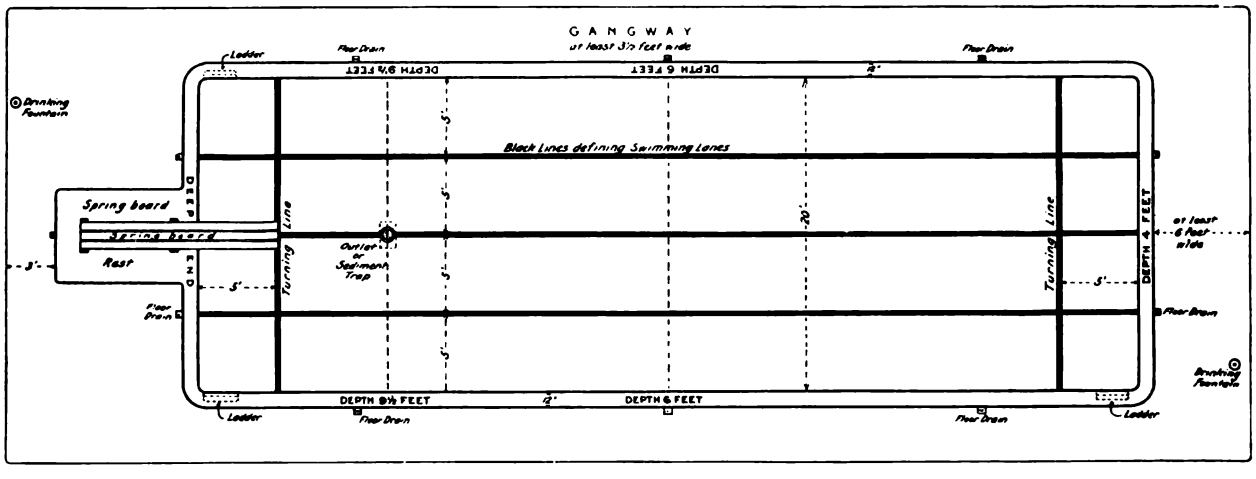
Plan of Another Public Bathhouse, Type IV.

the dressing rooms, when they enter the bathhouse, and an inner one, reserved for bathers only after they have undressed. A different plan is that in which all dressing rooms are located on an upper gallery, from which stairs lead the bather first to the cleansing baths. Only after these have been used are the bathers permitted to enter the pool. Whichever plan is followed, the bathing master should always have full control of the movements of the bathers.

Ample dressing room accommodation is essential. The partitions dividing the compartments may be made of structural opaque glass, of marble or of thin glazed tile blocks. A not inconsiderable saving in the initial cost of construction of free public baths can be effected by not using marble as the material for the shower bath and dressing room partitions. A bath interior can be made attractive and perfectly sanitary, and the compartments durably constructed, by using a cheaper, yet impermeable, non-absorbent and cleanable material, such as Alberene soapstone or even slate.

View of Men's Swimming Pool in Bathhouse, Plan of Which Is Shown at Right of Page 5.





Plan and Section of Swimming Pool. (By Courtesy of Associated Tile Manufacturers.)

The most important feature of a swimming bath, from a sanitary viewpoint, is, in my judgment, not the pool itself, but the preliminary cleansing bath. Sufficient attention is not always given to this essential part of a public bath house.

An adequate number of cleansing baths should be provided, and these should consist of—

(a) Shower baths with hot and cold water connections, and,

(b) Footbaths.

To insure greater privacy, particularly for women, during the ablution, which should be performed in the nude, before any bathing suits or trunks are put on, some compartments with light curtains should be fitted up. Partitions should be seven feet high, and may consist of marble or of other opaque and less costly material. The showers should have both upward and downward douche, the latter to perform a cleaning of the perineal region of the body. Free soap, preferably a disinfecting soap, and scrubbing brushes should be furnished by the bath attendant.

The footbaths are as necessary as the showers, yet I have not seen them provided for in any American bathhouse visited and inspected by me, whereas in European bathhouses they are quite the rule (see the illustrations). The footbaths consist of either a long single trough, standing free on all sides and having tempered water flowing through it continuously, or they consist of a series of individual porcelain or glazed earthenware fixtures, arranged back-to-back in the center of the cleansing room, which is a more sanitary arrangement.

Interior View of Lurline Baths, San Francisco

Wherever the plan permits, the cleansing baths should be located between the dressing rooms and the pool, in order to afford a good control of the bathers.

Much can be done to keep the water in a swimming pool sanitary by an efficient supervision and management of the bathers. A physical examination of the bathers while nude, to exclude the diseased, accomplishes much good, but it is difficult to enforce, except in Y. M. C. A. buildings and in school or military baths.

Rules should be posted in conspicuous places and strictly enforced, requiring all bathers who wish to use the pool, to use the preliminary cleansing baths, and to pay attention in particular to the cleaning of the feet, for which special fixtures are provided, and also of the loin regions. The use of soap should be made obligatory.

Attention should also be drawn to the toilets provided and the bathers advised to use the urinals before entering the pool.

Interior View of Sutro Bathhouse, San Francisco

The rules of conduct, posted in all dressing rooms, should state that all expectoration must take place either into cuspidors provided for, or into the scum gutter, but no spitting or blowing of the nose should be permitted in the pool. Offenders of the rules should be excluded from the privilege of using the swimming pool.

Bathers should either enter the pool nude, or wear the sterilized suits provided by the bath establishment. Male bathers may be permitted to wear small triangular loin cloths. Bathing suits for women must be sterilized after each use, and undyed garments are recommended, as the dye contributes to the discoloration of the pool water. Smoking or chewing tobacco in the bathhouse should be absolutely forbidden.

Brief mention should be made of some details of the equipment of swimming pools, which consist in mechanical or structural accessories but which have no special sanitary significance. Every pool should have one or more descending stairs, usually placed at the shallow end, while ascending ladders may be located at the deep end. Both the stairs and the ladders must be so arranged that they will have no obstructing projections in the water. The built-in ladders are often constructed in concrete and lined with tiling.

While the scum gutter usually performs the function of a life rail, in some cases a life rail of non-corrosive material is placed above the water surface. All pools used for swimming contests must have distance markers or numbers, indicating the length in yards from the starting point. These are placed on the long sides of the pool;

View of Swimming Pool for a Private House. *(Courtesy of Associated Tile Manufacturers.)*

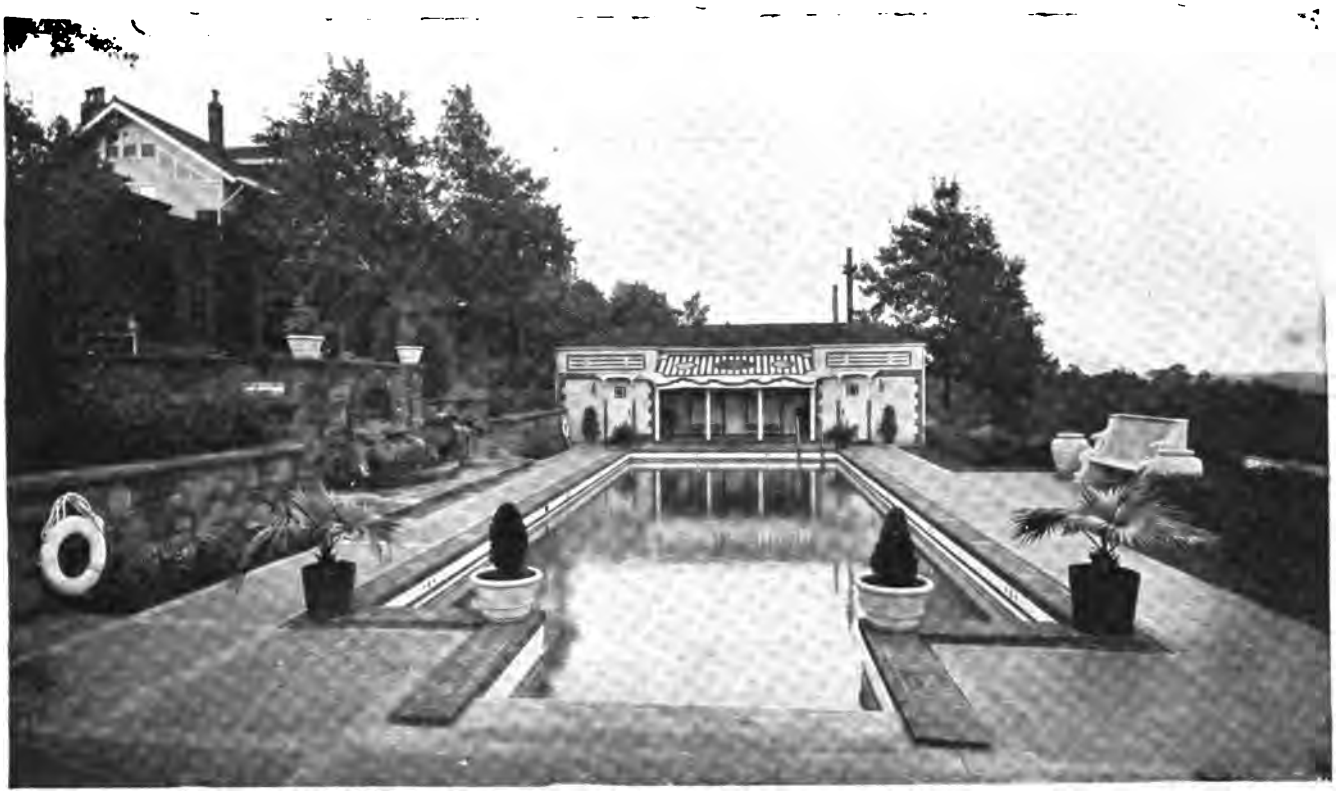
in the bottom lane markers are arranged to aid the swimmers. Other pools have deep and shallow water signs and ropes stretched across the width of the pool to divide it into one part for swimmers and another for non-swimmers.

At one of the corners, or sometimes in the center of the deep end a removable oak spring board, of proper thickness, held securely in bronze holders, is provided for jumping and diving feats. This should preferably be made adjustable for various lengths of overhang. Its usual width is 12 inches, and the end over the water should be covered with suitable corrugated material to prevent slipping.

At the sides of the swimming hall hose connections should be installed for the washing of the pool, when emptied; some pools are provided with vacuum cleaner hose connection to which a suction hose and nozzle are attached for the quick cleaning of the bottom of the pool. There should also be some life-saving belts or life-preservers hung on the walls.

In some of the exhibition pools sub-aqueous illumination by incandescent bulbs is arranged for, into the details of which this article cannot go. Among measures which indirectly assist in preventing the pollution of the pool I mention special water-flushed cuspidors, and the installation of a sufficient number of urinals and toilets, located near the cleansing baths, and conspicuously marked by easily read signs.

All plumbing fixtures in a bathhouse should be of the best, most durable and sanitary type. For waterclosets the suspended vitreous ware siphon-jet wall type of fixture, with extended front lip and with seat of the saddle-hole type, open at front and back, are recommended. The floor under the fixture thus remains free and is most easily kept clean. The flushing may be arranged by means of push-button valves, concealed in the floor. Urinals should be of glazed earthenware in niche form, but not extended down to the floor level, and in battery or duplex form, requiring no individual partitions. The flushing to be done much the same



View of Outdoor Pool. (Courtesy of Associated Tile Manufacturers.)

as in the case of waterclosets. Lavatories should be of heavy vitreous ware, secured to the wall by concealed supports, and provided with "pop-up" waste fittings. Drinking bubble fountains should be of the most recent type, having a parabolic or slanting stream, preventing the lips from touching the bubble orifice. (See illustration, page 11.)

All plumbing fixtures should be properly trapped by deep-seal traps: the lavatories and drinking fountains in particular to have non-siphoning traps of an approved tested type, and the entire plumbing system to be arranged on the continuous or loop vent plan, which does away with much of the useless concealed branch venting.

A few words should be said about public wading pools, river and sea baths. These are well patronized in summer time, because many persons prefer bathing in the open air, in sunshine, and in running water or in the surf. Such baths do not require pretentious architectural structures, but their sanitation, efficient supervision, and good maintenance are just as important as those of the urban bathhouse. The bathing pavilions usually consist of one-story structures, having numerous dressing rooms, toilet rooms, and a few showers in the alleys between the compartments.

View Showing Arrangement of Foot Baths

Wading pools are usually located in city parks and are supervised by the park authorities. The pools which are irregular in shape are constructed more economically than city swimming pools. The pools should be watertight and have a non-

View Showing Cleansing Showers and Foot Baths

staining surface and an attractive finish, for which the use of white Portland cement is advised.

Bathing in stagnant water of ponds or small lakes is not conducive to health, where there is a multitude of bathers, and for all artificially constructed wading pools a pure water supply, frequent renewal, and continuous control of the water, if necessary by sterilization, are required, as well as a limitation of the number of bathers per hour.

River and sea-side baths are, as a rule, operated as private commercial enterprises. In many instances unsanitary conditions prevail, hence a strict supervision by the health authorities is required.

In locating a river or beach bath, suitable water and shore conditions must be selected, and a sandy bottom is desirable. River baths are apt to become dangerous to health owing to location in proximity to sewer outfalls; it is preferable to locate them away from the heart of the city at a considerable distance upstream, where the water is comparatively free from contamination. Where the river conditions are unsuitable (insufficient depth or volume of water, or too great velocity of the stream, or a muddy or rocky bottom) special basins are often constructed on a site adjoining the river, and fed by the river water, which is sometimes passed through a sand filter, or strained by gratings to exclude the coarser floating impurities.

The houses of both river and beach baths are usually simple low wooden structures, located either on the shore, or on the water near the shore, and built on piles, or finally the entire structure is placed on floating pontoons, and connected with the shore by a bridge. The latter location presupposes that the sea is quiet and that there is not much rise and fall due to the tide.

The bath structures described should have well-equipped dressing rooms, and be provided with a safe drinking water supply, with sanitary bubble fountains, with adequate well-kept toilet facilities, with fire protection, and with good sewerage systems to avoid any pollution of the shore. Suitable regulations should be enforced to prevent the defiling of the beaches by the bathers. If there is a laundry for towels and bathing suits connected with the bathing establishment, this should be kept under close supervision.

At some European sea bathing resorts transportable bathing cabins on wheels are much in use.

View Showing Another Arrangement of Cleansing Baths.

It is generally not advisable to erect very large sea-bathing pavilions, a number of well-kept smaller bathing pavilions, which decentralize the crowds, being preferable.

III. The Water Supply and the Purification of Swimming Pool Water

The water supply for bath houses may be obtained either from the city water mains, or from an independent water plant on the premises. Municipalities often furnish water to the public bath houses free of charge, or at a merely nominal or special rate. Where the water works are owned by a private concern it is likewise often possible to obtain special concessions in the water rates, hence a street connection is usually preferable. Only where the water tax is very high, or where there is lack of water, does it pay to provide a well supply.

The quality of the water for bathing must fulfill the highest requirements regarding its purity. The water must be clear and pure, free from grosser suspended impurities and also free from pathogenic bacteria. If the water is turbid, filtration is required; if it contains much iron, an aeration and oxidation process must be applied to remove this. Organic impurities are removed by both aeration and filtration, or by other special treatment.

In public bath houses it is also advisable to install a drinking water supply. This comprises an ice-water system, provided by electrically operated automatic refrigerating machines, a cooling tank of suitable capacity with cooling coils submerged in the tank, and special mains and branches taken to the sanitary drinking fountains, which should be of the angle-pattern or slanting stream type (see illustration), in which the lips do not touch the fountain nozzle. A circulating pipe is essential to return the water to the cooling tank and thus to keep up a continuous circulation. All pipes carrying iced water should be insulated with cork covering.

In planning the water supply for a bath house, an engineer should carefully calculate the maximum daily volume of water required, and specify or obtain one or several connections with the city supply main. No objection should be made to a large connection because the refilling of a pool as a rule takes place at night, when other demands on the street main are at a minimum. But the engineer is, to a certain extent, at the mercy of the water department office, who issues the permits for the taps or service connections. Instances are on record where an engineer was refused a desired larger connection, the result being that soon after the bath house was put in operation the supply was found to be insufficient, and the small services granted had to be replaced by larger pipes.

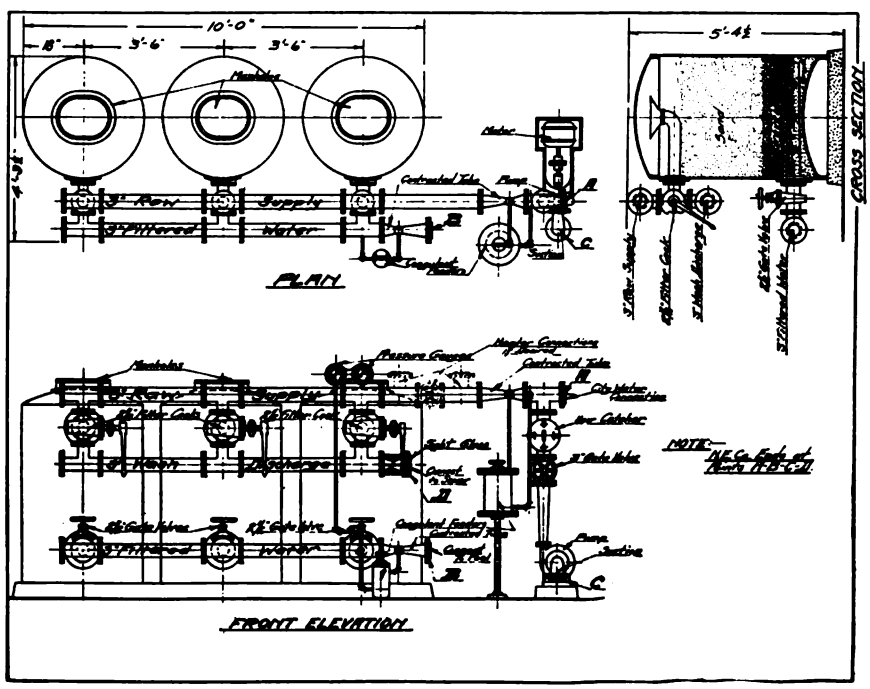
Angle-Pattern Sanitary Bubble Drinking Fountain (Courtesy of Crane Company).

The main supply should preferably be taken from two streets. Each line should have a control gate valve at the curb, made accessible by a service box. The two lines should be cross-connected in the cellar and the combined line should be metered. All main distributing lines should be properly valved.

It is rarely found to be necessary to filter or purify the supply for the showers; the supply for tub baths is occasionally filtered where the water is turbid or discolored, but the supply of water for the swimming pool must nearly always be treated, except in the case of an artesian well supply.

The fact that swimming in impure water may become a danger to health can no longer be disguised or disputed. The best medical authorities are agreed that intestinal, or eye and ear, or respiratory, or venereal diseases may result from bathing in contaminated water. The purification of pool water differs from drinking water purification, which is accomplished in a single treatment, because in the former problem we are dealing with a water to which impurities are constantly added. For this reason sanitary engineers are almost unanimous in claiming that either a continuous change of water, or else some form of treatment, or both, seem to be required. There are, however, opposing views regarding the best methods of accomplishing the desired results.

Some qualified engineers argue for a frequent emptying, cleaning and refilling of the pool, and in doing so have in



Re-Filtering or Re-Circulation System (Courtesy of the Norwood Engineering Co.)

mind that water is furnished either free or at reduced rates to the free baths. Others, equally competent and sincere, favor the dilution process, or refiltration and re-circulation. To do the subject justice both views should be considered, and it hardly seems fair-minded to call the advocates of one method modern and progressive, those of the other method antiquated or obsolete.

The important question, how frequently and how completely the water of a pool should be changed, both for sanitary and for aesthetic reasons obviously depends upon a number of factors, such as the size of the pool, the maximum daily number of bathers, the character of the bathers, and the season of the year. In other words: with the same average number of bathers per hour a small pool becomes more quickly contaminated than a large one; at times of a maximum attendance, whether its water is admitted fresh or re-filtered, a pool must be emptied oftener than at times of normal or small attendance; the water in a private club house pool requires changing less often than that of a Y. M. C. A. pool, and this again less often than that of a municipal or other free public swimming bath. As a rule, a pool does not require emptying in winter time as often as in summer; if once a week suffices in winter, emptying and cleaning should be done twice a week in summer.

The *ideal,* but practically unattainable standard is to empty, clean, scour and refill the pool once every twenty-four hours. The next best condition is to admit continuously a sufficient hourly flow of pure water (1/10 to 1/20 of the capacity of the pool) so that the water contents are changed at least once in 24 hours, and in addition to empty and thoroughly clean the pool at least once a week. The cleaning of sides and bottom can best be done after the pool has been drained, and the work must necessarily be done at night, or else on Sundays, if the bath house is then closed.

My personal belief is that satisfactory sanitary conditions can be obtained fully as much by the *prevention* of water contamination than by any treatment of the water after pollution has taken place. The fouling of the water by the introduction of dirt and disease germs can, as has already been explained, be largely prevented by strict attention to the cleanliness and cleanly habits of the bathers.

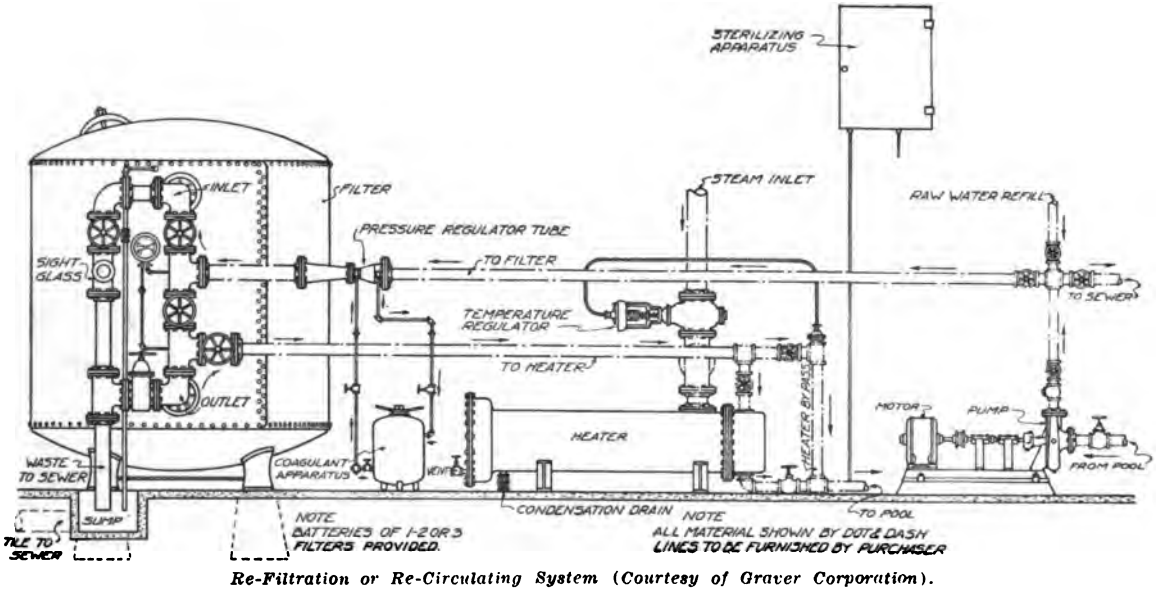
Unfortunately, economical considerations prevent, in some cases, the frequent renewal of the contents of a swimming pool, hence some compromise must be adopted in order to maintain an unobjectionable character of the pool water from a physical, chemical, bacteriological and aesthetic point of view.

The several available purification methods to restore the purity of the pool water, after its pollution, can be only briefly discussed in this article, and it is not my intention to bring a comparison of the treatments, however instructive such would be. The fact, however, should be mentioned that even in some of the best examples of swimming pool water treatment, a careful supervision of the method is not always practised. The results, accordingly, are far from satisfactory. It goes without saying that clear water is required in a pool to prevent drowning accidents, but clear water and pure water are two different things.

The simplest way to purify water is by the filtration method. When the water is continuously withdrawn from the pool, passed through a battery of filters, then re-heated and conveyed back into the pool and thus kept in circulation, we have the well-known refiltration system. (See illustrations.) The usual rate of filtration is 2 gallons per square foot of filtering area per minute; it is not advisable to exceed this limit. All good quartz sand filters will satisfactorily remove suspended matters from the pool water, and if one of the cylinders of a filter battery contains bone charcoal, a removal of discoloration of the water is also effected.

Four other methods of treatment of water have been introduced in recent years, viz:

(1) The treatment with hypochlorite of calcium;
(2) The treatment with liquid chlorine;
(3) The ozone treatment, and
(4) The sterilization of water by ultra-violet rays.



Re-Filtration or Re-Circulating System (Courtesy of Graver Corporation).

In all these methods the water is also re-filtered. The hypochlorite treatment has a marked effect in restoring the purity of water, but recently it has been superseded by the liquid chlorine treatment. Liquid chlorine is supplied in pressure cylinders, from which it is released in gaseous form by the opening of a graduated valve. One objection to both methods is the possibility of their causing irritation to the bathers' eyes or nostrils, or adding a disagreeable taste or odor to the water. The purification by ultra-violet rays avoids these objections. In this system the water is passed around clear quartz tubes, contained in a cylinder. Inside of the tubes are mercury vapor lamps, which generate ultra-violet rays, which destroy the bacteria. The ozone treatment of water consists in passing through it, at a predetermined rate, ozone, which is commercially generated in an ozonator. The gas being a strong oxidizing agent, kills the bacteria, disinfects the water, and improves its physical appearance.

I have given much thought and consideration to these various purifying systems, and am led to believe that some advocates go too far in making claims (as I have seen it stated) that the same water, if sterilized and filtered, can be used over and over again for periods varying from three months to 2½ years.

In my judgment none of the methods mentioned can be considered favorably except where the weekly emptying of the pool is also carried out. My reasons, briefly stated are:

(1) Filtration does not remove the salts in solution, the ammonia, urine, or any other polluting matter dissolved in the water;

(2) The effect of pollution in a pool which is only emptied at rare intervals, is likely to be a cumulative one, increasing as the frequency of change of water decreases.

(3) It is well known that many persons have an almost insuperable objection, largely on aesthetic grounds, to the bathing in water which has been used over and over again by a multitude of bathers.

In the re-filtration method, as usually practiced, only a small volume of the contents of the pool is removed during each bathing hour and then returned to the already polluted larger volume in the pool after filtration. Vastly better results could be accomplished if the pool were emptied during the night quickly by means of pumps of much larger capacity than those ordinarily installed. The pumps should circulate the contaminated water through filter batteries of adequate capacity, so that the next morning the entire pool may contain re-filtered water. Such a procedure is undoubtedly feasible, but it would involve a much greater expense than is ordinarily allowed for the purifying process.

In the many recent investigations of swimming pools bacteriological examinations have been the prominent feature, and the requirement has been upheld that the water supplied to the pool must conform with the bacterial standards of drinking water. This view, in my judgment, is too severe. We do not enter a pool for the sake of drinking its water. More importance should be attached by expert hygienists to the physical and chemical examinations of the water after its use by bathers. The number of bacteria in a water is a convenient, but not necessarily a convincing, test of its purity. It is the number of bacteria of intestinal origin, the pathogenic germs present, which alone interest us, and they bear no specific proportionate relation to the total number of bacteria present.

A very prominent German sanitary engineer, with whom I discussed the subject, stated the following sound opinion: "It is not the number of bacteria in the water which determines, *from a practical point of view,* the contamination of the pool, but rather the suspended and dissolved substances, the urine, the perspiration, the skin abrasions, the fat particles, the dirt and the soap carried in the swimming suits. Not all the matter passing into solution can *be removed by filtration.* The claims of the advocates of the artifical purification of the pool water have been greatly exaggerated and overestimated."

Some saving in the amount of the water and the coal bills can doubtless be effected by adopting either re-filtration, or water treatment, but this should not be the chief consideration. In estimating such saving, consideration should also be given to the initial cost of the filters or the treatment plant, the recurring expense for chemicals or electric current, of the amount of water used daily for washing the filters, and the incidental cost of the labor involved in the operations.

IV. Some Engineering Details of Bath House Installations

It remains to touch briefly upon some purely engineering features of the equipment.

The water supply lines may consist of either cast iron, galvanized wrought iron, steel, or brass and copper pipes. According to our present knowledge and practical experience, the larger mains, four inches or more in diameter, for both hot and cold water should be either the flanged cast iron pipe, or else the "Universal" pipes which have ground-in joints tightened with lugs and bolts. Bell and spigot pipes, put together with calked joints, may be permissible for the cold water lines only, and then they should have numerous substantial supports, but for the hot-water service pipes lead-calked joints do not prove durable in the long run.

Welded steel pipe, or preferably genuine hand-puddled wrought iron pipe, protected against corrosion by special galvanizing, or else by black enamel, may be used for the cold-water lines of smaller diameter than 4 inches. Seamless brass or copper pipes are the best material for hot water service lines up to 3 inches in diameter.

Where, owing to the higher first cost, brass or copper pipes cannot be used, it should be the aim of the constructing engineer to keep all pipes (if of iron) exposed to view and outside of floors, walls and partitions, as this will facilitate repairs of leaks when such occur.

The waterproofing of the main bath house floor should be pierced at as few points as possible. It is therefore best to run distribution lines *overhead* on the main floor, and not at the basement ceiling. If the distribution is made in the basement, as the two illustrations show, numerous branches to tubs, and to the showers are required, and leaky floors are often the result.

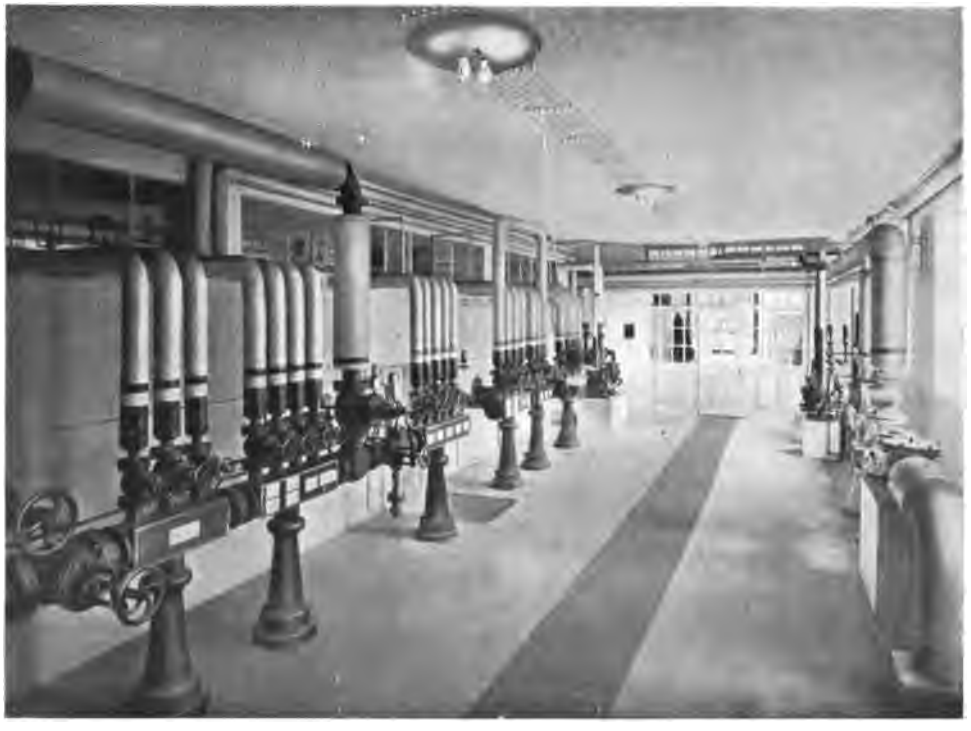
It is recommended to restrict the diameter of the douches with a view of preventing unnecessary waste of water, and for the same reason the holes in the shower heads should not be too numerous, nor unduly large. It

View of Pipe Distribution in a Public Bath House

is almost criminal to use in public bath houses douches, 6 to 8 inches in diameter, when a 4 or 4½ inch douche will easily afford a sufficient stream of water for bodily ablution. Water works superintendents should carefully look into this matter in cities where public bath houses exist, because a noticeable economy in water consumption can be accomplished. In the illustration is shown a type of douche, of German make, with easily adjustable and controlled delivery of water, and a recent American device, called an "Anyforce Douchehead" accomplishes indirectly the same purpose by having a lever handle control valve in the head, which regulates the force (and hence the volume of water) of the shower at will.

Anti-scalding shower mixing valves are not only expensive, but many are not altogether reliable in action. In the case of public bath houses it is much simpler, where the temperature of the hot water douches is kept at 110 to 115 degrees Fahr. to use ordinary hot and cold water valves to control the flow. Experience has demonstrated such an arrangement to be quite efficient while being cheaper in first cost and in maintenance.

The filtering of the water supply for the cleansing rain baths is superfluous from a hygienic point of view, nor is



View of Pipe Distribution in a Public Bath House

it required from a mechanical point of view to guard against the holes in the shower heads becoming obstructed, for these can be readily cleaned where the faces of showers are arranged so as to be removable.

The water for the pool, on the other hand, should be filtered, if it comes from a city main, except in cities having an exceptionally clear and pure water supply.

Section of Controlled Douche Head

This has already been pointed out in the preceding chapter.

The hot water supply for bathtubs, douche baths and the swimming pool may be arranged with, or without, storage tanks; the medium for heating the water is usually steam. It is best to provide separate water heating devices for each of the bathing appliances named, and to make the heaters, or the storage tanks, ample in capacity for a maximum bath house attendance.

Satisfactory results can be obtained for shower baths by keeping the temperature of the hot water at from 110 to 115 degrees. A higher temperature causes the perishable parts of faucets and valves to wear out more quickly; it increases the corrosion in steel and iron pipes; it also does away with the necessity of using expensive shower mixing valves to protect the bathers from getting scalded.

Electric Light Bath with Doors Opened

A suitable temperature for the pool water is 72 to 75 degrees Fahr., for bathing in tubs 86 to 95 degrees, and for the mixed water of douches 96 degrees.

The basement of a bath house should contain all the required engineering equipment, such as a boiler room with necessary coal bins, a pump room, engine room, a room for the filters and the water sterilizing apparatus, the hot water apparatus, a workshop and tool room, and an engineer's office. This, or the engineroom, should be connected by telephone with the swimming hall and the bath superintendent's office.

In many plans a complete laundry equipment is also provided in the basement, to wash the towels and bathing suits. Here we find washing machines, soap vats, centrifugal wringers, steam-drying apparatus, a steam mangle or an ironing machine. A laundry store room

Carbonic Acid Bath

for the clean towels and bathing suits is also required, but may be arranged on the main floor in connection with the ticket office.

NOTE.—Just as the recently introduced hand paper towels form a satisfactory substitute for the former unsanitary roller towels in public places, so it seemed to me something of a like nature might be contrived for use in bath houses. Several European firms have put on the market paper bath towels, which seem to be preferred by fastidious bathers, because each bather gets an entirely new towel. These towels are soft and pliable, yet sufficiently tough not to tear readily, and can be used for rubbing by merely folding them double.

The common bath towels should be sterilized after each use, which adds to the running expenses of a bath house; if not properly washed or sterilized they may transmit skin diseases. The expense of laundrying the bath towels, which forms a considerable item, and the unavoidable loss due to the stealing of towels, can be done away with, hence the introduction of paper bath towels is suggested as a step toward economy.

Public bath houses of American cities are but seldom equipped with the various arrangements comprised under the name of "Turkish" or "Russian" baths, hence they are not dwelt upon in this essay. Brief mention, how-

ever, should be made of certain forms of medical baths. Some of these consist in baths, in which certain substances, supposed to have a healing action, are added to the water.

One form of medical bath is the "carbonic acid" bath

Hydro-Therapeutic Control Table

(see illustration), consisting of the impregnation of the tub water with carbonic acid gas, obtained from pressure cylinders. Another form of medical bath, much used in hospitals in hydro-therapeutic treatments, is a control table (see illustration), usually having the sides and top of marble or structural glass, and fitted with thermostatic control mixing valves, thermometers, hose nozzles, etc., for supplying hot, cold or iced water under a pressure which can be regulated by the bath attendant. Still another form of medical bath is the now well-known electric light bath, consisting of a cabinet, the inside of which is fitted with a number of white or blue electric light bulbs, the interior walls being lined with mirrors. The cabinet is made both in the upright form and provided with chair for the patient to sit in, or else in oblong form for lying down. This form of bath is intended to induce perspiration action by the heat derived from the bulbs, and in this form becomes a substitute for the sun bath.

Mention should finally be made of some recent German swimming pools, which are provided with electro-mechanical arrangements on a large scale for creating in the pool an artificial wave action (see illustration). The same idea is applied on a smaller scale to tub baths.* German medical authorities have fully endorsed such baths, and claim for them good results as regards the hardening of the body.

* * * * * * * * * * *

The considerations outlined herewith, regarding the planning, equipment, supervision and enforcement of rules of conduct in public bath houses point conclusively to the fact that *the sanitation of bath houses and the hygiene of swimming pools can be largely secured by common-sense management and efficiency methods.*

*For a description of these "UNDOSA" wave baths see GERHARD, MODERN BATHS AND BATH HOUSES.

An Artificial Wave Bath

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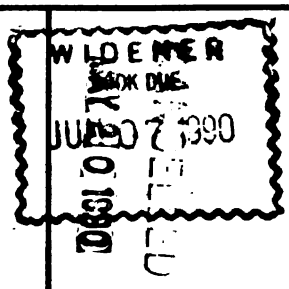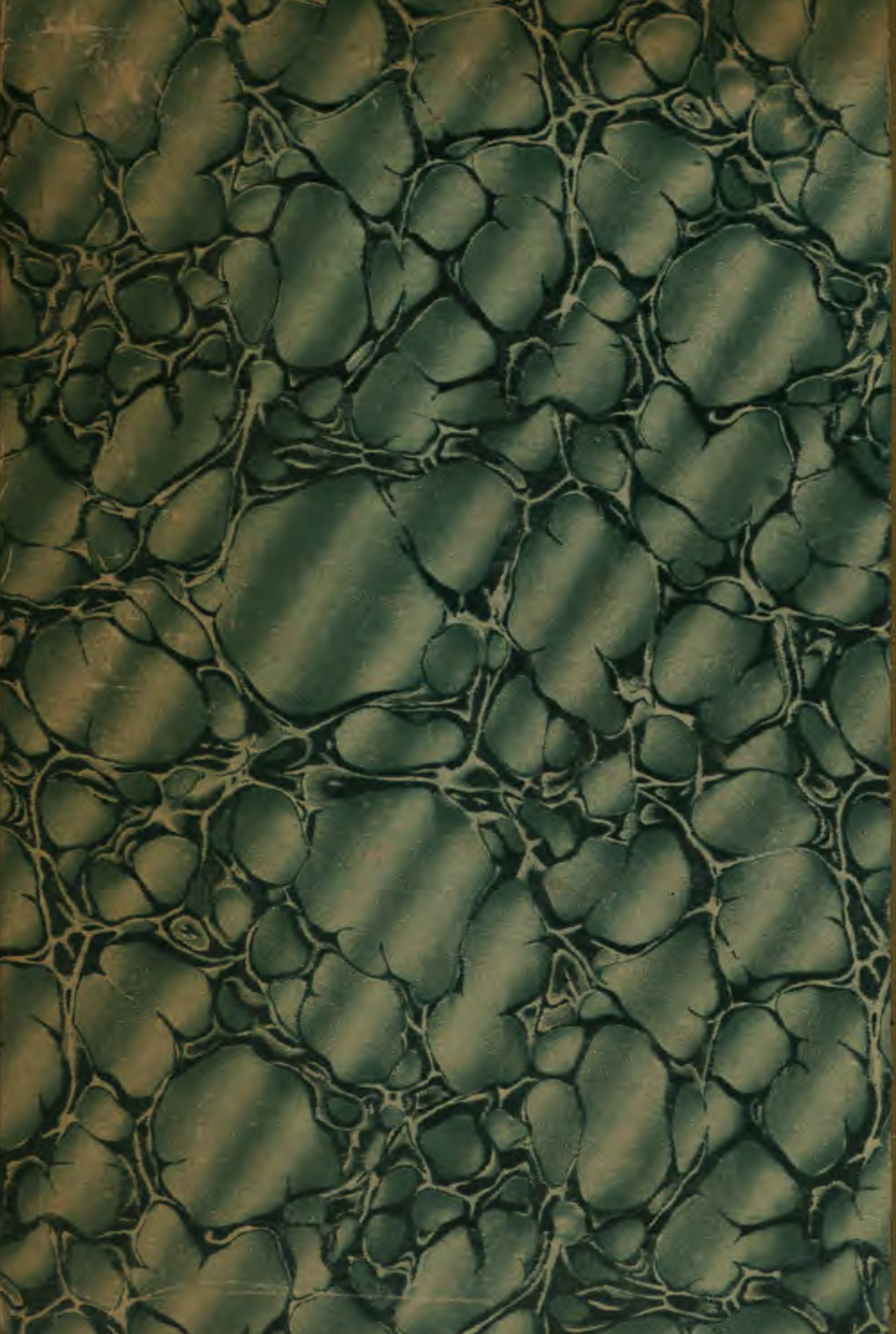
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